TOTAL MAXIMUM DAILY LOAD (TMDL)

For The Pesticide Carbofuran
in the Mermentau River and Vermilion-Teche River Basins

SUMMARY TABLE

Louisiana Standards Subsegment	22 subsegments in Mermentau and Vermilion-Teche River Basins
Parameter of Concern	Pesticides (carbofuran)
Numeric Target	Freshwater: 0.13 ug/l Marine waters: 0.23 ug/l
Uses Affected	Mermentau: propagation of fish and wildlife and oyster propagation in Coastal Bays and Gulf Waters Vermilion-Teche: propagation of fish and wildlife
Geographic Location	Mermentau: Southwestern Louisiana Vermilion-Teche: South Central Louisiana
Size of Watershed	Mermentau: 10,002.76 km^2 Vermilion-Teche: 10,464.81 km^2
Land Type	flatwoods, prairie, mixed hardwoods, marshland, coastal marine waters
Land Use/Cover	Mermentau: Agriculture (52.3%), Forest (8.4%), Wetlands (25.7%), Water (11.9%), Urban (1.3%), Other (0.4%) Vermilion-Teche: Agriculture (43.7%), Forest (10.7%), Wetlands (24.9%), Water (16.6%), Urban (3.1%), Other 0.9%)
Identified sources	Rice farming activities prior to 1999; FMC Corporation
TMDL for: Carbofuran	LA = variable depending upon flow (based on a representative flow for the major drainage(s) and concentration of 0.13 ug/l for freshwater or 0.23 for marine waters as appropriate) WLA for single point source (FMC) = Outfall 001: 0.00004 lbs/day Outfall 002: 0.000009 lbs/day In addition to the TMDL values, no introduction of carbofuran, which causes local concentrations to be greater than the numeric target, will be authorized.

TOTAL MAXIMUM DAILY LOAD (TMDL)

For The Pesticide Carbofuran in the Mermentau River and Vermilion Teche River Basins Including the Following 303(d) listed subsegments:

Bayou Petite Anse (060901)
Bayou Des Cannes (050101)
Grand Lake (050701)
Intracoastal Waterway (050702)
Mermentau River BasinCoastal Bays and Gulf Waters to State 3-mile limit (050901)
Bayou Teche (060205)
Bayou Des Glaises Diversion Channel (060207)
Bayou Teche (060301)
Bayou Teche (060401)
Tete Bayou (060701)
Vermilion River (060801)
Vermilion River (060802)
Vermilion River Cutoff (060803)
Bayou Carlin (Delcambre Canal) (060902)
Bayou Tigre (060903)
New Iberia Southern Drainage Canal (060904)
Intracoastal Waterway (060906)
Franklin Canal (060907)
Boston Canal and Associated Canals (060910)
Dugas Canal by Tiger Lagoon Oil & Gas Field (060911)
Bayou Petite Anse (061101)
Intracoastal Waterway (061102)

US EPA Region 6

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Executive Summary

Twenty-two stream segments in the Mermentau and Vermilion-Teche River Basins are listed for pesticides on the 1999 court-ordered 303(d) list for Louisiana. A watershed approach was used in developing this Total Maximum Daily Load (TMDL). This approach is most appropriate when addressing predominately nonpoint source issues such as pesticides where inputs are distributed throughout the watershed.

This TMDL establishes watershed level controls including the 22 listed segments in the Mermentau and Vermilion-Teche River Basins. Pesticide target values for numerous currently used pesticides have been calculated. These numeric targets are not the same as a water quality standard, but a numeric value that represents the Environmental Protection Agency's (EPAs) interpretation of Louisiana's water quality narrative standard for toxics as it applies to pesticides. EPA calculated this numeric target in accordance with procedures outlined in the State of Louisiana Water Quality Standards for toxics and supporting documentation submitted to EPA Region 6. Available pesticides data has been screened against these target values, with carbofuran being a pesticide that met the criteria for partial or non-support.

Carbofuran is a broad spectrum carbamate pesticide especially effective on controlling the rice weevil. FMC Corporation located in Opelousas, St. Landry Parish, LA, is the only point source formulating liquid, powdered and granular forms. The granular form, used exclusively in rice farming in Louisiana, was banned in the U.S. in 1994. Because no substitutes were available and rice growers were actively seeking alternatives, EPA extended its use on rice until August 1996. The phase-out was extended again in 1996 for another two years (1997 and 1998) under FIFRA Section 24(c) Special Local Needs registrations because registration of substitutes was imminent but not yet available. Louisiana Department of Agriculture and Forestry (LDAF) reported no stocks of granular carbofuran were remaining at dealers in Louisiana at the end of the 1998 season. Although, there is no ban on the liquid and powdered formulations, these are classified as Restricted Use Pesticides (RUP) because of their acute oral and inhalation toxicity to humans. LDAF reports the liquid form is occasionally approved for use on cotton crops for the control cotton aphids when other measures fail.

This TMDL is based on EPA developed numeric targets appropriate for freshwater (0.13 ug/l) and marine (0.23 ug/l) environments. It is assumed that the listed subsegments have no assimilative capacity for carbofuran loading at concentrations above the numeric targets for fresh or marine waters. The wasteload (WLA) and load allocation (LA) cumulatively for the Mermentau and Vermilion-Teche River Basins should not cause or contribute to exceedances of these numeric targets. Attainment of the narrative objective for toxicity and protection of the fresh and marine water habitat and wildlife habitat beneficial uses for these watersheds is expected because granular carbofuran was banned from use and is no longer produced and other forms have restricted use application. In addition to the TMDL values, no introduction of carbofuran, which causes local concentrations to be greater than the numeric target, will be authorized. Ambient monitoring for carbofuran will be conducted for three years to obtain additional data. At the end of three years, the data will be analyzed to determine compliance with the numeric target for freshwater and marine environments.

List of Abbreviations

CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
CWA	Clean Water Act
EPA	Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
LA	Load Allocation
LC_{50}	Concentration at which 50% of the test organisms die
LDAF	Louisiana Department of Agriculture and Forestry
LDEQ	Louisiana Department of Environmental Quality
MCL	Maximum Contaminant Level
MDL	Method Detection Level
MOS	Margin of Safety
NAWQA	National Water Quality Assessment
NPDES	National Pollutant Discharge Elimination System
RUP	Restricted Use Pesticide
TMDL	Total Maximum Daily Load
ug/l	Micrograms Per Liter
USGS	U.S. Geological Survey
WLA	Wasteload Allocation

1.0 Introduction

Section 303(d) of the Clean Water Act (CWA) as amended by the Water Quality Act of 1987, and EPA's regulations at 40 CFR 130 require that each state identify those waters within its boundaries not meeting water quality standards. Section 303(d) of the CWA further requires that states develop TMDL management plans for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a water body can assimilate without violating the State's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources. TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLAs) for point sources and Load Allocations (LAs) for nonpoint sources, including a margin of safety (MOS) and natural background conditions.

2.0 Study Area Description

2.1 Mermentau River Basin

The Mermentau River Basin, located in southwestern Louisiana, encompasses the prairie region of the state and a section of the coastal zone (Figure 1). The Mermentau River Basin is bounded on the north and east by the Vermilion-Teche River Basin, on the west by the Calcasieu River Basin and on the south by the Gulf of Mexico (LDEQ 1996).

The northern part of the basin is upland area dominated by flat woods and prairie. Large expanses of flat grassland and scattered areas of oak trees and other mixed hardwoods characterize the prairie region. The southern portion of the basin, the coastal area, is marshland. The slope of the land is generally north to south. Poor drainage and annual backwater flooding of agricultural lands characterize the region, especially in the prairie and marsh areas, due to its relatively low relief.

The Mermentau Basin is sparsely populated outside its small municipalities and land use is dominated by silviculture and agriculture in the upper half of the watershed and by agriculture in the lower half. Of the approximately 600,000 acres statewide planted in rice annually, 280,000 acres or 46% are attributed to the Mermentau River Basin (personal communication with Butch Stegall of LDAF). Land uses for the Mermentau River Basin, summarized in Table 1, were derived from 1995 satellite interpreted National Land Cover Data (NLCD) produced as part of a cooperative project between the U. S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (USEPA).

2.2 Vermilion-Teche River Basin

The Vermilion-Teche River Basin is located in south-central Louisiana (Figure 1). The upper end of the basin lies in the central part of the state near Alexandria, and the basin extends southward to the Gulf of Mexico. The basin is bounded on north and northeast by a low escarpment and the lower end of the Red River Basin. The Atchafalaya River Basin is to the east, Mermentau River Basin is to the west and the Gulf of Mexico to the south. (LDEQ 1987) Land use in the Vermilion-Teche Basin is largely agriculture, the primary crops being soybeans,

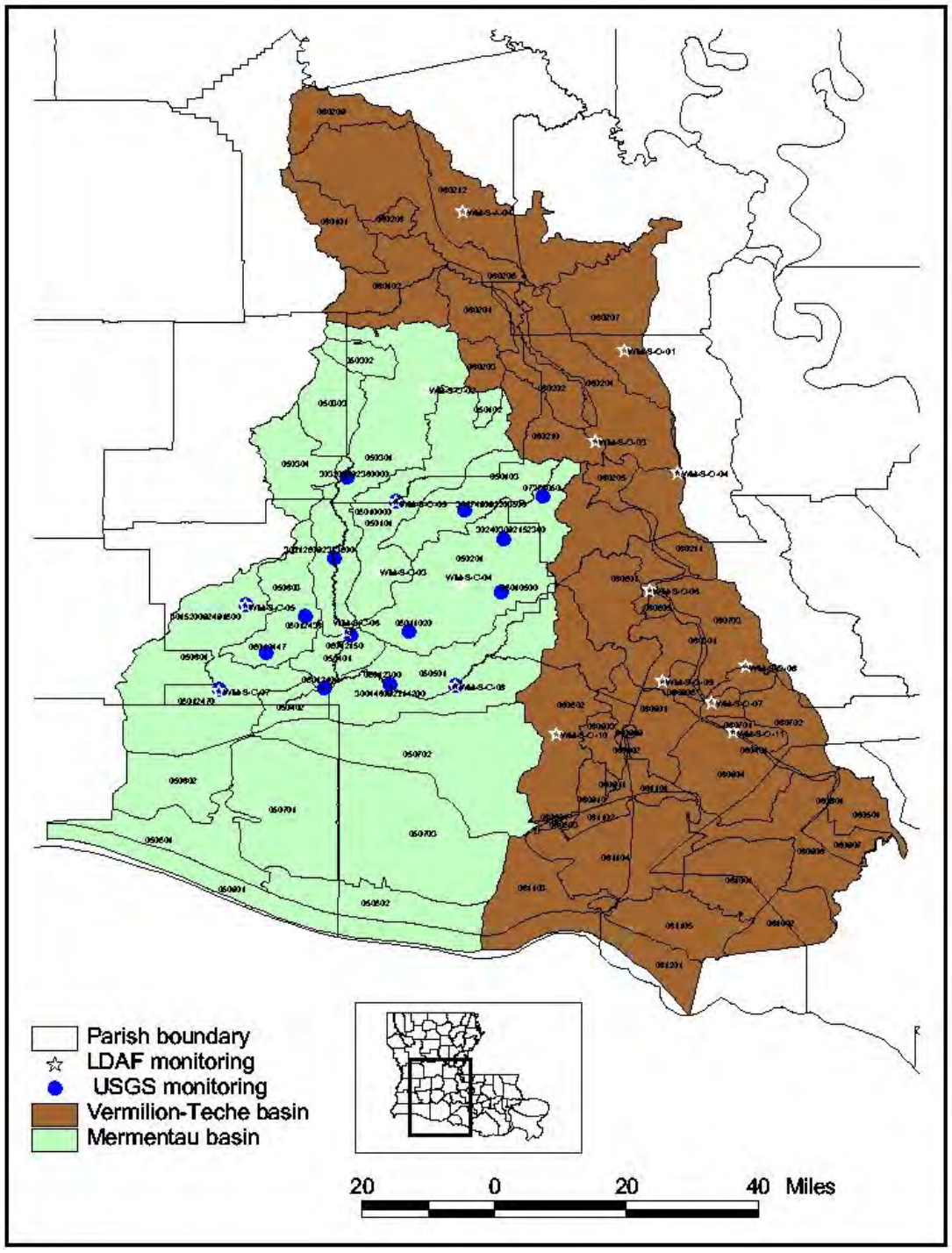

Figure 1. Map of the Mermentau and Vermilion-Teche River Basins. LDAF monitoring sites are shown as red dots and USGS monitoring sites are shown as blue dots.

sugarcane and rice. Of the approximately 600,000 acres statewide planted in rice annually, 60,000 acres or 10% are attributed to the Vermilion-Teche River Basin (personal communication with Butch Stegall of LDAF). The area is sparsely populated outside Lafayette and its small municipalities. Land use is dominated by agriculture. Land uses for the Vermilion Tech River Basin, summarized in Table 2, were derived from 1995 satellite interpreted National Land Cover Data (NLCD) produced as part of a cooperative project between the U. S. Geological Survey (USGS) and the U.S. Environmental Protection Agency (USEPA).

Table 1. Land Use (km^2) in the Mermentau River Basin

Coverage Type	Area km^2	Percent of Watershed
Cropland and Pasture	5,234.48	52.3%
Water	1,192.27	11.9%
Non-forested Wetland	2,145.18	21.4%
Forested Wetland	430.39	4.3%
Evergreen Forest	421.61	4.2%
Deciduous Forest	266.56	2.7%
Urban	126.28	1.3%
Mixed Forest	145.18	1.5%
Other	40.81	0.4%
TOTAL	10,002.76	100%

Table 2. Land Use (km^2) in the Vermilion-Teche Basin

Coverage Type	Area km^2	Percent of Watershed
Cropland and Pasture	4,568.06	43.7%
Water	1,740.01	16.6%
Non-forested Wetland	1,407.05	13.4%
Forested Wetland	1,208.53	11.5%
Evergreen Forest	494.07	4.7%
Deciduous Forest	423.47	4.0%
Urban	322.84	3.1%
Mixed Forest	208.07	2.0%
Other	92.71	0.9%
TOTAL	10,464.81	100%

2.2 Problem Statement

Twenty-two subsegments in the Mermentau and Vermilion-Tech River Basins (Table 3) were included on the 1999 court-ordered Louisiana 303(d) list as not fully supporting the water quality standard with “pesticides” listed as the cause of nonsupport. These original assessments were based largely on the best professional judgment of Louisiana Department of Environmental Quality (LDEQ) regional coordinators, often without the benefit of quantitative data. The rationale for many of these listings was the fact that since the predominant land use is

agriculture, then the possibility for pesticide impairment in the watershed existed. This is further supported by the fact that no specific pesticide was identified as the problem, just pesticides in general. Therefore, informal, qualitative observations rather than quantitative data were the basis for many of these listings. Because the listings are for pesticides in general, the first step was to identify which pesticides, if any, may be contributing to water quality standards impairments.

2.3 Water Quality Standards

Designated uses include primary contact recreation, secondary contact recreation, and propagation of fish and wildlife for all the subsegments listed in Table 3. In addition, subsegments 050101, 050701, 050702, 060801 and 060802 have agricultural use designations and subsegment 050901 has an oyster propagation designation. A number of the listed subsegments are estuarine.

LDEQ's Antidegredation Policy (LAC 33:IX.1109.A) was reviewed and this TMDL is consistent with that policy.

Narrative criterion for toxic substances may be found in the Louisiana Water Quality Standards at §1113.B.5. This reads:

> "No substances shall be present in the waters of the state or the sediments underlying said waters in quantities that alone or in combination will be toxic to human, plant, or animal life or significantly increase health risks due to exposure to the substances or consumption of contaminated fish or other aquatic life. The numerical criteria (LAC 33:IX.1113.C.6) specify allowable concentrations in water for several individual toxic substances to provide protection from the toxic effects of these substances. Requirements for the protection from the toxic effects of other toxic substances not included in the numerical criteria and required under the general criteria are described in LAC 33:IX.1121. "

Criteria for toxic substances may be found in the Louisiana Water Quality Standards at §1113.C.6. This reads:

> 6b. The criteria for protection of aquatic life are based on acute and chronic concentrations in fresh and marine waters as specified in the EPA criteria documents and are developed primarily for attainment of the fish and wildlife propagation use. Where a specific numerical criterion is not derived in EPA criteria documents, a criterion is developed by applying an appropriate application factor for acute and chronic effects to the lowest LC50 value for a representative Louisiana species.
>
> 6c. Criteria for human health are derived using EPA guidelines, procedures, and equations for water bodies used as drinking water supplies and those not used as drinking water supplies. Criteria applied to water bodies designated as drinking water supplies are developed to protect that water supply for human consumption, including protection against taste and odor effects, to protect it for primary and secondary contact recreation, and to prevent contamination of fish and aquatic life consumed by humans. Criteria for water bodies not designated as drinking water supplies are developed to protect them for primary and secondary contact recreation and to prevent contamination of fish and aquatic life consumed by humans. In some cases, the maximum contaminant levels (MCLs) from the National Drinking Water Regulations, when more restrictive, are used as the criteria. For those toxic substances that are suspected or proven carcinogens, an incremental cancer risk level of 10^{-6} (1 in 1,000,000) is used in deriving criteria, with the

Table 3. Court ordered listing (1999) for the Mermentau and Vermilion-Teche River Basins.

LDEQ Subsegment	Description	Designated Uses
	Mermentau River Basin	
050101	Bayou Des Cannes - Headwaters to Mermentau River	A B C F
050701	Grand Lake	A B C F
050702	Intracoastal Waterway - Mermentau River to Vermilion Locks	A B C F
050901	Coastal Bays and Gulf Waters to 3-Mile Limit	A B C E
	Vermilion-Teche River Basin	
060205	Bayou Teche – Headwaters at Bayou Courtableau to I-10 (combined with 060301 during last tri-annual review)	A B C
060207	Bayou des Glaises Diversion Channel/West Atchafalaya Borrow Pit Canal - from Bayou Des Glaises to Bayou Courtableau	A B C
060301	Bayou Teche – I-10 to Keystone Locks and Dam	A B C
060401	Bayou Teche - Keystone Locks and Dam to Charenton Canal	A B C
060701	Tete Bayou	A B C
060801	Vermilion River - Headwaters at Bayou Fusilier-Bourbeaux junction to New Flanders (Ambassador Caffery) Bridge, Hwy. 3073	A B C F
060802	Vermilion River – From New Flanders (Amabssador Caffery) Bridge, Hwy. 3073 to Intracoastal Waterway	A B C F
060803	Vermilion River Cutoff - From Intracoastal Waterway to Vermilion Bay *	A B C
060901	Bayou Petite Anse - Headwaters to Bayou Carlin *	A B C
060902	Bayou Carlin (Delcambre Canal) Lake Peigneur to Bayou Petite Anse *	A B C
060903	Bayou Tigre - Headwater to Bayou Petite Anse *	A B C
060904	New Iberia Southern Drainage Canal - origin to Weeks Bay *	A B C
060906	Intracoastal Waterway - New Iberia Southern Drainage Canal to Bayou Sale *	A B C
060907	Franklin Canal	A B C
060910	Boston Canal and Associated Canals *	A B C
060911	Dugas Canal by Tiger Lagoon Oil and Gas Field *	A B C
061101	Bayou Petite Anse -Bayou Carlin at Fresh-brackish marsh boundary to Vermilion Bay *	A B C
061102	Intracoastal Waterway - Levee at Segment 0611 and 0609 boundary to New Iberia Southern Drainage Canal *	A B C

* Estuarine waters

A – primary contact recreation; B – secondary contact recreation;
C – propagation of fish and wildlife; E- Oyster propagation; F – Agriculture

exception of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and hexachlorocyclohexane (lindane, gamma BHC), in which case 10^{-5} (1 in 100,000) is used to derive the criteria.

2.4 Evaluating Pesticides Data

To develop a TMDL it is necessary to establish quantitative measures that can be used to establish the relationship between a pollutant (pesticide) and its impact on water quality. Once a pesticide has been identified, a numeric target value for that pesticide which distinguishes between the impaired and unimpaired state of the water body must be established (USEQP, 1999). LDEQ has adopted numeric criteria for a number of pesticides, including Aldrin, Chlorodane, DDT, TDE(DDD), DDE, Dieldrin, Endosulfan, Endrin, Heptachlor, Lindane and Toxaphene. It was recognized that this list of pesticides is very limited and does not fully represent currently used pesticides. In order to access pesticides currently in use, they must first be identified.

A review of the LDAF data (1992-1999) identified 26 pesticides (Appendix A-1) with values reported at levels above method detection levels (MDL). In the absence of numeric criteria for these 26 pesticides, EPA developed a numeric target for each of these pesticides. EPA developed numeric target values do not represent a water quality criterion or standard; rather, it is a numeric target used by EPA to assess if a water body would be reasonably expected to be impaired based on the state's no toxics in toxic amounts narrative criterion. These numeric target values were established in accordance with procedures outlined in the State of Louisiana Water Quality Standards for toxics and supporting documentation submitted to EPA Region 6 (Appendix B-1). A more comprehensive description can be found in Appendix B-2 "Rationale for Development of Screening Levels in Louisiana 303(d) Streams Listed for Pesticides".

Two data sets containing data for a wide range of pesticides were identified: 1) the U.S. Geological Survey (USGS) National Water Quality Assessment (NAWQA) Program representing the water years 1999 and 2000 and 2) LDAF quarterly pesticide monitoring network data collected from established ambient stream monitoring stations since 1992 (Figure 1). The LDAF data set targets pesticides for monitoring according to crop types in the watershed above the station. Although, data were not available for each subsegment, the spatial coverage of the basins (see Figure 1) was sufficient to establish a general assessment of pesticides, which may be contributing to an impairment of the narrative water quality standard for toxics. Based on the spatial coverage of the data and the similarity in primary land use (Mermentau: 52% and Vermilion-Teche: 44% agriculture), it is reasonable to do a watershed TMDL covering both the Mermentau and Vermilion-Teche River Basins.

Once numeric targets were established, the most recent three years of data (Appendices C and D) from each data set was reviewed with respect to the calculated numeric target values. Exceedances of either the acute or chronic numeric target values were noted for each impaired water body. If a pesticide concentration did not exceed its numeric target value more than once in a three-year period, the water body was considered to be fully supporting. If a pesticide concentration exceeded its numeric target value two or more times during a three year period, the percentage of samples in which this occurred was used to further assess the water body as either partially supporting or not supporting with regard to the pesticide of concern. Waterbodies identified as partially supporting or non-supporting require a TMDL.

Carbofuran was one of the 26 pesticides found in concentrations reasonably expected to be harmful to freshwater aquatic life (Appendix E) or human health. Carbofuran exceeded the numeric targets in several subsegments including Bayou Des Cannes, Mermentau River, Bayou Queue de Tortue and Bayou Laccassine. These subsegments combine to represent major drainages. Bayou Des Cannes flows into the Mermentau River, which is the major drainage for the Mermentau Basin headwaters. Bayou Queue de Tortue also flows into the Mermentau River in the lower portion of the basin. Bayou Laccassine is a separate drainage in the lower portion of the Mermentau Basin but to the west of the Mermentau River.

2.5 Carbofuran

Carbofuran is a broad spectrum carbamate pesticide that kills insects, mites, and nematodes on contact or after ingestion. It is used against soil and foliar pests of field, fruit, vegetable and forest crops. Carbofuran is available in liquid, powdered and granular formulations; however, the graunle form was banned in the U.S in 1994. Trade names include Furadan, Bay 70143, Carbodan, Carbosip, Chinofur, Curaterr, D 1221, ENT 27164, Furacarb, Kenafuran, Pillarfuron, Rampart, Nex, and Yaltox. Formulations of carbofuran are in toxicity class I - highly toxic or toxicity class II – moderately toxic. FMC Corporation is the primary manufacturer (Extoxnet Pesticide Information Profile – June 1996). Prior to 1991, 80% of the total usage of carbofuran was in granular formulations, which were very effective for controlling rice weevil infestations. Granular carbofuran was used exclusively in rice farming to control the rice weevil. There is no ban on liquid or powdered formulations of carbofuran. These formulations are classified as Restricted Use Pesticides (RUP) because of their acute oral and inhalation toxicity to humans. LDAF reports that liquid and powered forms of carbofuran are not used in rice farming; however, liquid formulations are used in cotton and wheat production with prior approval from LDAF. This is the only current use of carbofuran in Louisiana.

Carbofuran is highly toxic to many fish. The LD50 (96-hour) is 0.24 mg/L in bluegill sunfish (Kidd and James, 1991). The compound has a low potential to accumulate in aquatic organisms. The bioconcentration factor ranges from 10 in snails to over 100 in fish (Howard, 1991).

2.5.1 Environmental Fate

Carbofuran is soluble in water and is moderately persistent in soil. Its half-life is 30 to 120 days. In soil, chemical hydrolysis and microbial processes degrade carbofuran. Hydrolysis occurs more rapidly in alkaline soils (Howard, 1991). Carbofuran breaks down in sunlight. Carbofuran has a high potential for groundwater contamination. It is mobile to very mobile in sandy loam, silty clay, and silty loam soils; moderately mobile in silty clay loam soils; and only slightly mobile in muck soils (Howard, 1991).

In water, carbofuran is subject to degradation by chemical hydrolysis under alkaline conditions. Photodegradation and aquatic microbes may also contribute to degradation. The hydrolysis half-lives of carbofuran in water at 25^{o}C are 690, 8.2, and 1.0 weeks at pH values of

6.0, 7.0, and 8.0, respectively. Carbofuran does not volatilize from water, nor does it adsorb to sediment or suspended particles (Howard, 1991).

2.6 Carbofuran Sources

2.6.1 Nonpoint Sources

As previously discussed, the most significant source of carbofuran in the Mermentau and Vermilion-Teche River Basins was from applications to rice fields to control the rice weevil. Land use analysis shows that in the Mermentau and Vermilion-Teche River Basins, 52% and 44% of the land area is cropland or pasture, respectively. Approximately 56% of the rice grown statewide in Louisiana is grown in the Mermentau and Vermilion-Teche River Basins.

Exceedances in the carbofuran chronic numeric target value (0.13 ug/l) for freshwater aquatic life protection occurred primarily in June and July (1999 and 2000) and twice in March 2000. In a 1994 study of pesticides in storm water runoff, Domagalski (1996), reported that carbofuran in surface waters of the Sacramento River Basin, CA, a rice farming area, is probably not attributable to storm water runoff, but rather to current management practices including the flooding of fields to promote more rapid degradation of the rice stubble. In these studies, carbofuran concentrations measured in the rice field prior to, during and after storm events were not significantly different. The presence of carbofuran in surface water was attributed to the flooding and subsequent drainage of the rice fields rather than runoff from storm events. In Louisiana, the growing season ranges from late February through September. Surface water from bayous and streams or ground water from wells is used to flood the fields prior to planting (late February until early June). Shortly after flooding, the seed is water planted. Once the rice seed has germinated, the water is drained and the field is flooded again. Prior to the banning of carbofuran granules, it was applied to flooded fields in May and June at the rate of 0.6 lbs of active ingredient per acre for control of the rice weevil. The field water is then held until two weeks prior to harvest (mid July through September depending upon when the rice was planted) at which time it is released. It is believed that this practice contributed the greatest loads of carbofuran to the system.

2.6.2 Point Sources

There are no known point sources of carbofuran in the Mermentau Basin; therefore, the WLA will be set to zero.

One point source discharger, FMC Corporation's Agricultural Products Group plant (FMC), located in Opelousas, St. Landry Parish, is the only known point source in the Vermilion-Teche Basin. FMC is authorized to discharge under NPDES Permit LA0064360 and Louisiana Water Discharge Permit No. WP0259. FMC currently formulates and packages carbofuran ("Furadan"®) in various commercial strengths. Water is used in the formulation process. However, according to plant procedures it is consumed in the process and there is no generation of process wastewater and, hence, no discharge of process waste water at their facility. FMC has two outfalls. Outfall 001 consists of discharge from a facultative lagoon, which only receives sanitary wastewater. Outfall 002 consists of surface (storm) water runoff

from an area of approximately 5.1 acres. Effluent from both outfalls flow into a ditch, thence into Del Puent Swamp and thence into Little Bayou Teche.

3.0 TMDL Load Calculations

3.1 Current Load Evaluation

Carbofuran loads have been calculated using the chronic numeric target (0.13 ug/l) and stream flow. The following equation can be used to calculate carbofuran loads.

Equation 1: C x 0.001 x Q in cfs x 5.39 or C x 0.001 x Q in MGD x 8.34

Where: C = concentration in mg/L
Q = stream flow in cfs or MGD

A traditional expression of the carbofuran loading may be developed by setting one critical or representative flow and concentration, and calculating the carbofuran loading using Equation 1. For the purpose of calculating current critical loading for these basins, the chronic carbofuran numeric target for freshwater was used as the concentration in conjunction with the critical flow (7Q10) at the lower portion of the major drainages in each basin (Table 4). Using these values and Equation 1, the estimated current loading for the February-September growing season for each drainage is given in Table 4. The same approach can be used to calculate the allowable carbofuran loading for marine waters. Since the marine chronic target value (0.23 ug/l) is almost twice its freshwater counterpart and the fact that rice is not grown in estuarine environments and therefore no additional carbofuran will be introduced in the estuarine environments. Therefore, it is believed that if the freshwater environment is protected, then the marine environment will also be protected by default.

Table 4. Estimated freshwater carbofuran loading for major drainages in the Mermentau and Vermilion-Teche River Basins

Basin	Drainage/Location	7Q10 (cfs)	Concentration (ug/l)	Loading (lbs/day)
Mermentau	Mermentau River above Lake Arthur	68.52[1]	0.13	0.048
Mermentau	Bayou Lacassine above Grand Lake	1.22[2]	0.13	0.000085
Vermilion	Vermilion River at Surrey St.(Lafayette)	4.0[3]	0.13	0.0028
Teche	Bayou Teche @ Keystone Lock and Dam	309[4]	0.13	0.22

1. 7Q10 value obtained from projection runs contained in the Mermentau River Watershed TMDL for Dissolved Oxygen Including WLAS for Two Treatment Facilities (Baker, 1999)
2. 7Q10 value obtained from projection runs contained in Bayou Lacassine Watershed TMDL for Dissolved Oxygen Including WLAS for Two Treatment Facilities (FTN, 1999).
3. 7Q10 value obtained from Low-Flow On Streams In Louisiana (Lee, 2000)
4. 7Q10 value obtains from the Bayou Teche Watershed TMDL for Dissolved Oxygen (LDEQ, Jan. 5, 2000)

3.2 TMDL

A phased approach is the most appropriate method because of the limited amount of data to support the 1999 Court Ordered Listing for subsegments impaired due to pesticides in the

Mermentau and Vermilion-Teche River Basins. In the initial phase, the TMDL is calculated using the limited amount of data available. The second phase consists of development and implementation of a three-year monitoring plan to assess the effectiveness of this TMDL. At the end of phase two, the data will be analyzed to determine if the TMDL has resulted in attainment of the chronic numeric target for freshwater (0.13 ug/l) and marine environments (0.23 ug/l) or needs some adjustment to bring the basins into attainment.

Flow is a critical element in establishing a TMDL. Point sources usually have a defined critical receiving stream low flow such as the 7Q10 at which the criterion must be met. For nonpoint sources it is recognized that there may be no single critical flow condition. To address this condition, a TMDL carbofuran loading curve for (Figure 2) for the growing season (February thru September) has been generated. This TMDL loading curve was developed using Equation 1 and substituting the carbofuran concentration with the freshwater chronic numeric target (0.13 ug/l) and varying the flows. The attempt here is to show that while a TMDL may be expressed as a single point, it can also be thought of as a continuum of points representing the numeric target and various flow values. This curve may be applied to any freshwater stream. A similar curve was developed for use with estuary and marine streams using 0.23 ug/l as the numeric target (Figure 3). Together, these curves represent the TMDL loading allocation for carbofuran in the Mermentau and Vermilion-Teche River Basins. For example, a 7Q10 flow at the Mermentau River above Lake Arthur has been used for expressing the TMDL as a load. This point is shown on the freshwater loading curve (Figure 2).

Utilizing Figure 2, one can select a freshwater stream flow value (x-axis) and can quickly determine the TMDL carbofuran loading value. For example, a 7Q10 flow (68 cfs) at the Mermentau River above Lake Arthur has been used for expressing the TMDL as a load. This point is shown on the freshwater loading curve (Figure 2). Likewise, using Figure 3, one can select an estuary or marine stream flow value (x-axis) and can quickly determine the TMDL carbofuran loading value. The line formed by this series of points may be thought of as a boundary. At any given flow, the loading calculated from ambient in-stream concentrations may be below the line, within the boundary, or above the line. Such loading values represent the observed or current condition. Therefore, observed carbofuran load values falling above the line represent high values relative to the numeric target and need to be reduced. Likewise, observed carbofuran loading values falling below the line represent low loads relative to the numeric target value and no action is needed.

Load reductions are only necessary when the calculated observed loading value falls above the line in Figures 2 and 3 depending upon whether the stream of concern is freshwater or marine. For example, say the observed concentration in the Mermentau River above Lake Arthur is 0.2 ug/l and the observed flow is 68 cfs. Using equation 1, the observed load would be 0.0733 lbs/day. This value falls above the line in Figure 2, therefore a load reduction is needed. Equation 2 below can be used to calculate the needed reduction. Therefore, subtracting the TMDL load (0.048 lbs/day) from the observed load (0.0733 lbs/day) equals 0.0253 lbs/day representing the needed reduction.

Equation 2. Current (observed) Load – TMDL load = Load Reduction

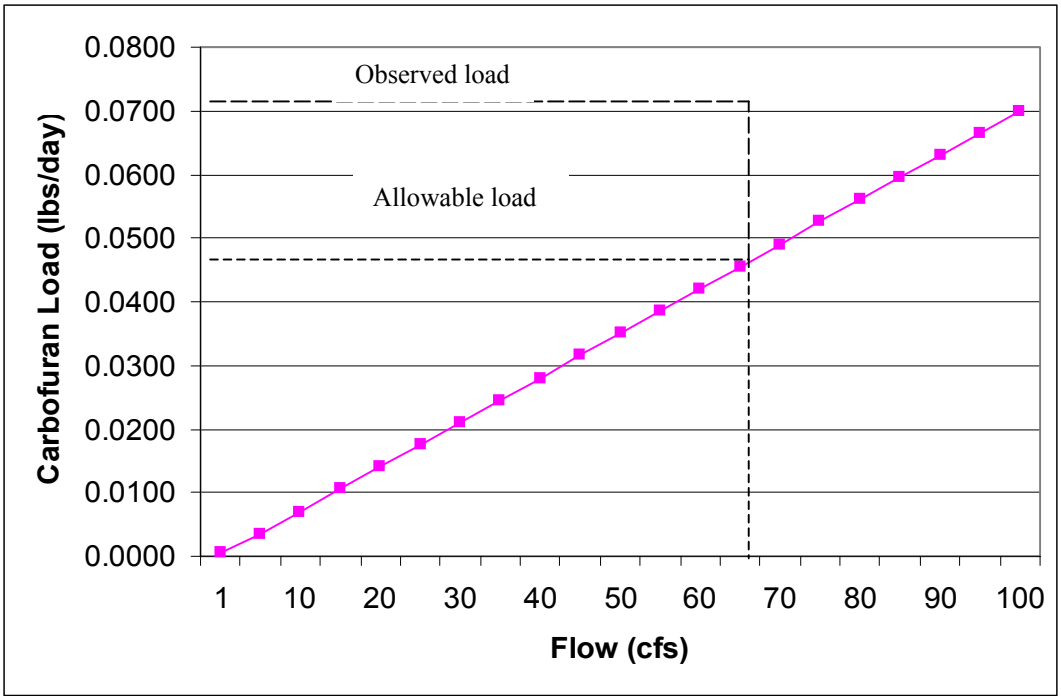

Figure 2. TMDL carbofuran loading curve for freshwater.

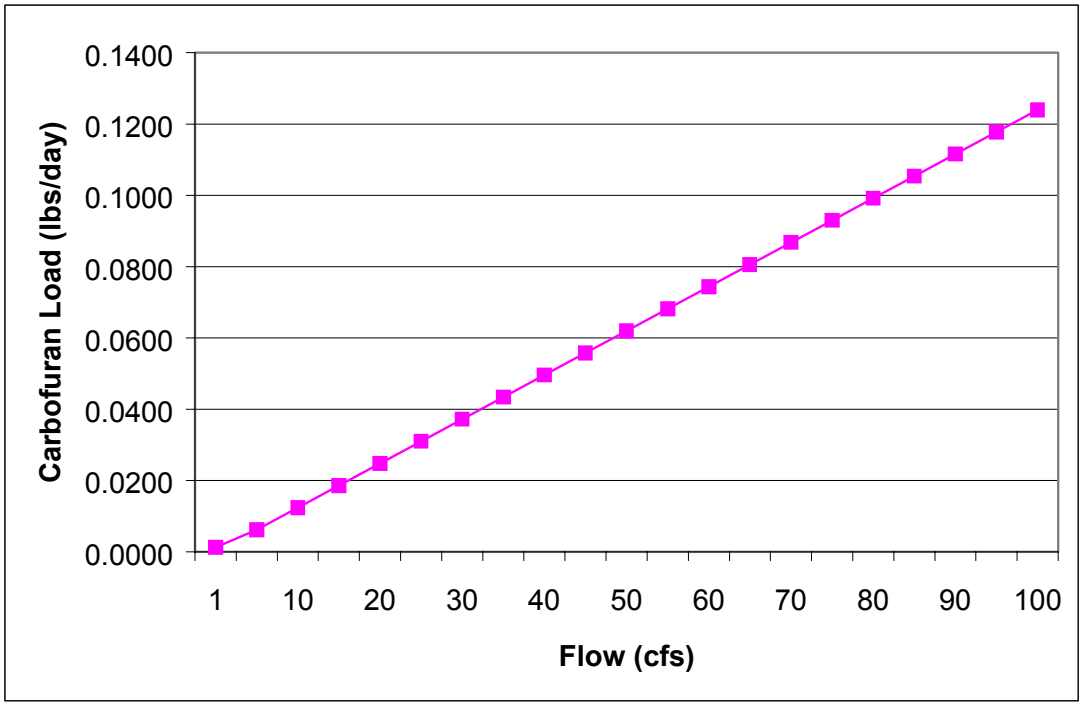

Figure 3. TMDL carbofuran loading curve for estuaries and marine waters.

The load reduction value can be converted into a percent reduction using Equation 3 below. In our example, the percent reduction required is the load reduction (0.0253 lbs/day) divided by the observed load (0.0733 lbs/day) times 100; therefore, the percent reduction is 34.5%.

Equation 3. Load Reduction / Current Load x 100 = % reduction

3.3 Wasteload Allocation (WLA)

As previously stated, there are no point sources in the Mermentau River Basin and the WLA is set to zero. There is a single point source (FMC) in the Vermilion-Tech River Basin. Equation 1 can be used to calculate the wasteload allocation and observed or current load for the single point source (FMC) using the chronic numeric target of 0.13 ug/l of carbofuran and discharge flow at each outfall. The discharge flow used represents the 3-year (Jan 1998 – Dec 2000) average of monthly discharge flow reported in the DMR reports from outfall 1 (0.0377 MGD) and outfall 2 (0.0079 MGD). Therefore, the TMDL WLA for FMC is calculated as follows:

Outfall 001: 0.13 ug/l carbofuran x 0.001 x 0.0377 MGD x 8.34 = 0.00004 lbs/day

Outfall 002: 0.13 ug/l carbofuran x 0.001 x 0.0079 MGD x 8.34 = 0.000009 lbs/day

3.4 Load Allocation (LA)

As mentioned previously, this TMDL is written to cover subsegments in two adjacent watersheds: the Mermentau River Basin and the Vermilion-Teche River Basin. Therefore, the load allocation for a given flow can be calculated using Equation 1 and the following relationship:

(TMDL @ given flow and numeric target) – (WLA) = LA

In addition to the basin-wide LA, no introduction of carbofuran which causes localized concentrations to be greater than the appropriate numeric target (freshwater: 0.13 ug/l or marine:0.23 ug/l) will be authorized.

3.5 Seasonal Variation

Section 303(d)(1) requires that all TMDLs be "established at a level necessary to implement the applicable water quality standard with seasonal variations. A review of the data shows that, in general, values greater than the numeric target value for freshwater and estuarine waters are more likely to occur in the months of March, June and July, all of which fall within the growing season. Therefore, the growing season from late February through September is identified as the critical period. Also, because it has been determined the most likely impact is from draining of rice fields and not necessarily storm water events, it is more likely that impacts will be observed during low flow conditions. For this reason, low flow conditions, defined as a 7Q10, have been used in the calculation of the TMDL loads.

3.6 Margin of Safety

The CWA requires that each TMDL be established with a MOS. This requirement for a MOS is intended to account for uncertainty in available data or in the actual effect controls will have on the loading reductions and receiving water quality. A MOS may be expressed explicitly as unallocated assimilative capacity or implicitly through conservative analytical assumptions used in establishing the TMDL. The MOS is not intended to compensate for failure to consider known sources. Because of the nature of the pollutant and the fact that its use has been severely limited, it was determined that an implicit MOS was appropriate for this TMDL.

4.0 Reasonable Assurance and Other Relevant Information

The goal of this TMDL is to reduce carbofuran concentrations in the Mermentau and Vermilion–Teche River Basins to meet the water quality objectives for toxicity and pesticides in these watersheds. Attainment of these targets and allocations are expected to result in attainment of the narrative objectives for toxicity and pesticides, and, hence, protect the marine and warm freshwater habitat and wildlife habitat beneficial uses in these two watersheds.

In 1991, due to avian risk concerns, the registrant voluntarily canceled granular carbofuran on rice and its use on rice was to be phased out by 1994 coinciding with the EPA initiated ban (effective September 1, 1994) on all granular formulations. The ban was established to protect birds and is not related to human health concerns. Bird kills have occurred when birds ingested carbofuran granules, which resemble grain seeds and when predatory or scavenging birds have ingested small birds or mammals, which had eaten carbofuran pellets. Because no substitutes were available and rice growers were actively seeking alternatives, EPA extended the use of carbofuran on rice until August 1996. The phase-out was extended again in 1996 for another two years (1997 and 1998) under FIFRA Section 24(c) Special Local Needs registrations because registration of substitutes was imminent but not yet available. In 1998, at the request of Louisiana, EPA allowed an additional 39,000 lbs. of carbofuran for use on rice in Louisiana because of higher than normal infestations due to the mild winter (el nino) (EPA Fact Sheet 1999). The Louisiana Department of Agriculture (LDAF) approved grower access to the additional carbofuran based on proven need. FIFRA Section 24(c) is still in place today, which allows farmers to use any remaining product. LDAF reported no stocks of granular carbofuran were remaining at dealers in Louisiana at the end of the 1998 season.

There is no ban on liquid or powdered formulations of carbofuran. These formulations are classified as Restricted Use Pesticides (RUP) because of their acute oral and inhalation toxicity to humans (Appendix F). LDAF reports that liquid and powered forms of carbofuran are not used in rice farming; however, liquid formulations are used in cotton and wheat production with prior approval from LDAF. This is the only current use of carbofuran in Louisiana.

As previously discussed the most widespread use of carbofuran in these basins was for historic applications for rice farming. Action has been taken that has eliminated this source of carbofuran. Additional restrictions have been established to reduce other sources of carbofuran.

5.0 Regulatory Authority

LDAF is the lead agency for pesticide regulatory control in Louisiana. The jurisdiction and authority of LDAF relative to pesticide matters is set out in the Louisiana Pesticide Law (Title 3 of the Louisiana Revised Statutes). Under the state regulatory system, the commissioner has the authority to adopt rules and regulations necessary to implement the provisions under this law including but not limited to rules and regulations governing the registration, distribution, sale, offering for sale, and application of pesticides. Furthermore, the commissioner has the authority to establish emergency procedures involving imminent danger to human health or the environment.

Under the Louisiana Pesticide Law, each pesticide, which is sold, offered for sale, or distributed in Louisiana, is registered annually. Proper certification is required to apply or supervise the application of any restricted use pesticide as a private applicator. Proper licensing is required for individuals who own or operate a business engaged in the applications of pesticides for a fee. A key component of enforcement is that it is illegal to make a pesticide recommendation or application inconsistent with the labeling or in violation of the EPA or state restriction on the use of that pesticide.

It is the responsibility of the commissioner to determine when the concentrations of pesticide wastes exceed promulgated federal or state standards, or when the concentrations of pesticides pose a threat or reasonable expectation of a threat to human health or to the environment. When such determinations are made, the commissioner shall decide the appropriate action to be taken.

LDAF monitors quarterly for the presence of pesticides in the waters of Louisiana. Determinations of excessive levels are based on scientific and technical information. Investigations may be conducted to facilitate such determinations. Excessive pesticide concentrations are alleviated through minimizing, mitigating, and preventing the potential for excessive levels. If necessary, appropriate enforcement actions may taken.

6.0 Public Participation

When EPA establishes a TMDL, the Agency provides the public an opportunity for comment concerning the TMDL. EPA will commence preparation of a notice seeking comments, information and data from the general and affected public. If comments, data or information are submitted during the public comment period, then the TMDL may be revised accordingly. After considering public comment, information and data, and making any appropriate revisions, EPA will transmit the revised TMDL to the Court, and to the LDEQ for incorporation into LDEQ's current water quality management plan.

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APPENDIX A-1: Recommended Freshwater Aquatic Life Protection Numeric Targets for Pesticides in Louisiana TMDL Development

CAS #	Name	Conc. (ug/l) LC50	Acute Numeric Level (ug/l)	Chronic Numeric Level (ug/l)	Species
94757	2,4-D	6,539	654	327	*Micropterus dolomieui*
15972608	Alachlor		760	76	EPA Recommended Criteria
101053	Anilazine	3	0.3	0.15	*Ceriodaphnia dubia*
1912249	Atrazine		328.6	11.56	Draft EPA Recommended Criteria
28249776	Benthiocarb	510	51	25.5	*Ceriodaphnia dubia*
314409	Bromacil	186,000	18,600	9,300	*Pimephales promelas*
1563662	Carbofuran	2.6	0.26	0.13	*Ceriodaphnia dubia*
81777891	Clomazone	34,000	3,400	1,700	*Lepomis macrochirus*
21725462	Cyanazine	12,693	1,269	635	*Ictalurus punctatus*
333415	Diazinon		0.1	0.1	Draft EPA Recommended Criteria
99309	Dichloran	1.08	0.11	0.055	*Lepomis macrochirus*
55290647	Dimethipin	20,900	2,090	1,045	Daphnia sp.
120068373	Fipronil	45.6	4.6	2.3	*Lepomis macrochirus*
2164172	Fluometuron	3,157	316	158	*Ameiurus melas*
51218452	Metolachlor		390	100	EPA Recommended Criteria
298000	Methyl Parathion	3.4	0.34	0.17	Southern House Mosquito
21087649	Metribuzin		N/A	100	EPA Recommended Criteria
2212671	Molinate	327	32.7	16.35	*Lepomis macrochirus*
27314132	Norflurazon	16,300	1,630	815	*Lepomis macrochirus*
19666309	Oxidiazon	2,400	240	120	*Daphnia magna*
40487421	Pendimethalin	280	28	14	*Ceriodaphnia dubia*
7287196	Prometryne	10,000	1,000	500	*Lepomis macrochirus*
709988	Propanil	1,540	154	77	*Ceriodaphnia dubia*
60207901	Propiconazole	2,925	292	146	*Lepomis macrochirus*
5902512	Terbacil	33,948	3,395	1,697	*Lepomis macrochirus*
59669260	Thiodicarb	27	2.7	1.35	*Daphnia magna*
55335063	Tricorpyr	4,243	424.3	212	Mayfly
1582098	Trifluralin	32.3	3.23	1.62	*Lepomis macrochirus*

LC_{50} values used – 48 hour for invertebrates and 96 hour for vertebrates

APPENDIX A-2: Recommended Marine Aquatic Life Protection Numeric Targets for Pesticides in Louisiana TMDL Development

CAS #	Name	Conc. (ug/l) LC50	Acute Numeric Level (ug/l)	Chronic Numeric Level (ug/l)	Species
1563662	carbofuran	4.6	0.46	0.23	*Penaeus dourarum*
120068373	fipronil	130	13	6.5	*Cyprinodon variegatus*

LC_{50} values used – 48 hour for invertebrates and 96 hour for vertebrates

APPENDIX B-1: State of Louisiana Water Quality Standards for toxics and supporting documentation submitted to EPA Region 6

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF WATER RESOURCES
WATER POLLUTION CONTROL DIVISION
JUNE, 1989

DOCUMENTATION OF NUMERICAL CRITERIA FOR ACUTE AND CHRONIC AQUATIC LIFE PROTECTION IN THE 1989 WATER QUALITY STANDARDS REVISION

Numerical criteria for fresh water and marine water aquatic life protection as listed in Table 1 of the proposed 1989 Water Quality Standards revision were derived from criteria documents of the Environmental Protection Agency. Aquatic life criteria for the following toxic substances were taken directly from those recommended in the EPA document Quality Criteria for Water 1986:

1. Aldrin
2. Chlordane
3. DDT
6. Dieldrin
7. Endosulfan
8. Endrin
9. Heptachlor
10. Hexachlorocyclohexane (gamma BHC, Lindane)
11. Polychlorinated Biphenyls, Total (PCB's)
12. Toxaphene
13. 2, 4-Dichlorophenoxyacetic acid (2, 4-D)
14. 2-(2, 4, 5-Trichlorophenoxy) propionic acid (2, 4, 5-TP, Silvex)
46. Arsenic
47. Chromium III (Tri) - Freshwater Acute and Chronic only
48. Chromium VI (Hex)
49. Zinc

Numerical criteria for aquatic life protection for the remaining toxic substances were not directly available from EPA and were derived from LC50 data for each toxic substance as presented in the following EPA documents; (1) Ambient Water Quality Criteria, 1980. EPA Series 440/5-80 and (2) Ambient Water Quality Criteria. 1984. EPA Series 440/5-84-85. To derive a criterion value, an application factor was multiplied by the lowest reported LC50 value for a representative Louisiana species as listed in Table 1 of the EPA criteria documents. Appliction factors used were those recommanded in the EPA Water Quality Criteria 1972 (p. 123) and Quality Criteria for Water 1976 (p. 2, 3). This approach was developed in cooperation with Region VI EPA. For nonpersistent or noncumulative toxic substances, an application factor of 0.1 was used for acute protection and 0.05 was used for chronic protection. For persistent or cumulative toxic substances, an application factor of 0.05 was used for acute protection and 0.01 was used for chronic protection. The use of application factors provides a safety consideration to protect all life stages of a test species as well as to protect associated species that have not been tested and may be more sensitive to the tested toxic substance.

The following is a listing of the lowest reported LC50 values and representative Louisiana species utilized to derive numerical criteria.

Toxic Substance	Class [1]	Species [2]	LC50 [3]
4. TDE (DDD)	P	Scud	0.6
		Oyster	25
5. DDE	P	Planarian	1,050
		Oyster	14
15. Benzene	NP	Bluegill [4]	22,490
		P. pugio	27,000
16. Carbon Tetrachloride	NP	Bluegill	27,300
		T. Silverside	150,000
17. Chloroform	NP	Daphnia m.	28,900
		Pink Shrimp	81,500
18. Ethylbenzene	NP	Bluegill [5]	32,000
		M. bahia	87,600
19. 1, 2-Dichloroethane (EDC)	NP	Fathead minnow	118,000
		M. bahia	113,000
20. 1, 1, 1-Trichloroethane	NP	Fathead minnow	52,800
		M. bahia	31,200
21. 1, 1, 2-Trichloroethane	NP	Daphnia m.	18,000
	No data for Marine Water Species		
22. 1, 1, 2, 2-Tetrachloroethane	NP	Daphnia m.	9,230
		M. bahia	9,020
23. 1, 1-Dichloroethylene	NP	Daphnia m.	11,600
		M. bahia	224,000
24. Trichloroethylene	NP	Daphnia p.	39,000
		P. pugio	2,000
25. Tetrachloroethylene	NP	Daphnia m.	8,500
		P. pugio	1,300
26. Toluene	NP	Bluegill	12,700
		P. pugio	9,500
27. Vinyl Chloride	No Aquatic Toxicity Data Reported		
28. Bromoform	NP	Bluegill	29,300
		Sheepshead minnow	17,900
29. Bromodichloromethane	No Aquatic Toxicity Data Reproted		

Toxic Substance	Class [1]	Species [2]	LC50 [3]
30. Methylene Chloride	NP	Fathead minnow	193,000
		M. bahia	256,000
31. Methyl Chloride	NP	Bluegill	550,000
		T. Silverside	270,000
32. Dibromochloromethane	No Aquatic Toxicity Data Reported		
33. 1, 3-Dichloropropene	NP	Bluegill	6,060
		M. bahia	790
34. 2-Chlorophenol	NP	Daphnia m.	2,580
	No Data for Marine Water Species		
35. 3-Chlorophenol	No Aquatic Toxicity Data Reported		
36. 4-Chlorophenol	NP	Bluegill	3,830
		Sheepshead minnow	5,350
37. 2, 3-Dichlorophenol	No Aquatic Toxicity Data Reported		
38. 2, 4-Dichlorophenol	NP	Bluegill	2,020
	No Data for Marine Species		
39. 2, 5-Dichlorophenol	No Aquatic Toxicity Data Reported		
40. 2, 6-Dichlorophenol	No Aquatic Toxicity Data Reported		
41. 3, 4-Dichlorophenol	No Aquatic Toxicity Data Reported		
42. Phenol (total)	NP	Daphnia m.	7,000
		P. pugio	5,800
43. Benzidine	NP	Red Shiner	2,500
	No Data for Marine Water Species		
44. Hexachlorobenzene	No Aquatic Toxicity Data Reported		
45. Hexachlorobutadiene	P	Fathead Minnow	102
		P. pugio	32
47. Chromium III	P	Oyster	10,300

1. P - persistent; application factors - 0.05 (acute), 0.01 (chronic)
   NP - nonpersistent; application factors - 0.10 (acute), 0.05 (chronic)

2. First listed species for Freshwater
   Second listed species for Marine Water

3. LC 50's reported in ug/L, parts per billion

4. Grass shrimp, Palaemonetes pugio

5. Mysid shrimp, Mysidopsis bahia

PROCEDURES FOR HUMAN HEALTH CRITERIA CALCULATION IN LOUISIANA

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May 11, 1994

Introduction

The development of numerical criteria for human health protection follows guidance established by the U.S. Environmental Protection Agency (EPA). This guidance is established in a series of EPA documents including publications in the Federal Register. The approach used in developing the human health criteria for the Louisiana Surface Water Quality Standards was originally described in a Documentation Report for the 1989 Louisiana Water Quality Standards, prepared by the Louisiana Department of Environmental Quality, Office of Water Resources (LDEQ-OWR) in June, 1989.

The basic approach used by LDEQ-OWR to develop numerical water quality criteria for human health involves the review of toxicological data for each substance of concern in state waters. Substances of concern are derived from assessment of monitoring programs for water, fish and sediments, discharge and toxic release data, and other relevant information on state waters including the biennial state Water Quality Inventory (305(b) report). EPA's Integrated Risk Information System (IRIS) is used to establish the latest toxicological information on each substance. If the substance is designated as a carcinogen then the appropriate cancer potency slope factor (SF) is obtained; if it is designated a non-carcinogen, then the reference dose (RfD) is obtained. Bioconcentration factors (BCF) are also reviewed through appropriate data bases and updated if necessary. This information is then combined with other appropriate factors in the risk assessment formula to derive the criteria. Other factors considered in the formula include body weight, risk level, fish consumption, drinking water intake, and incidental ingestion while swimming. Categories of criteria are then developed for each toxic substance for drinking water (Public Water Supplies), non-drinking water, and non-swimming water (Secondary Contact).

For those toxic substances in which no toxicological data are available in the IRIS data base, the primary or secondary standards from the drinking water regulations, if available, may be used to provide a level of human health protection. As a special level of protection for drinking water supplies, taste and odor criteria may be used for

those substances associated with taste and odor problems.

The basic formulas, illustrated below, were obtained from a Federal Register notice, November 28, 1980. Further explanation and description of these guidelines can be found in *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual*. The 1980 Federal Register notice established the use of 2 liters for the average water consumption and the use of 70 kilograms for an average adult body weight. Carcinogenic SFs and non-carcinogenic RfDs are obtained from EPA's IRIS. The fish consumption rate of 20 grams per day used in the formulas was obtained from the U.S.Department of Agriculture's 1984 National Consumption Statistics. A health risk level of one in a million (10^{-6}) has been established for determining criteria for carcinogens with the exception of dioxin and lindane, which have been assigned a 10^{-5} risk level. Additionally, a SF is figured into the formula if the chemical has been given a cancer classification of A, B1, B2, or C. If the chemical has not yet been shown to be a carcinogen, or, if it has been shown that it is not a carcinogen, then a RfD is used instead of a SF.

For water bodies with the designated use of primary contact recreation (swimming), an incidental ingestion rate is included in the formula. The incidental rate is given by this formula:

$$\frac{250ml}{hour}\ possible\ ingestion \times \frac{5hrs}{wk}\ swimming\ duration \times \frac{6mos}{12mos}\ swimming\ season \times \frac{1week}{7days} = 89 \times \frac{ml}{day} = 0.089 \frac{liters}{day}\ incidental\ ingestion$$

The following are descriptions of items used in the risk-based formulas:

10^{-6}	= risk level
70 kg	= average adult male body weight
BCF	= bioconcentration factor in L/kg
0.02 kg/day	= national average amount of fish/shellfish consumed daily in kilograms (20 g/day)
SF	= cancer potency slope factor in $mg/kg/day^{-1}$
RfD	= reference dose in mg/kg/day
2 L/day	= national average amount of water consumed daily in liters

The equation for a carcinogen in waters designated as public water supply is:

$$Criteria\ \frac{mg}{L} = \frac{(10^{-6})\ (70kg)}{SF[0.089L/day + 2L/day + (BCF)\ (0.02kg/day)]}$$

The following equation is for a non-carcinogenic chemical in water bodies designated as public water supplies:

$$Criteria\ \frac{mg}{L} = \frac{RfD \times 70\,kg}{0.089\,L/day + 2\,L/day + (BCF)\,(0.02\,kg/day)}$$

The equation for a carcinogen in waters not designated as public water supplies is:

$$Criteria\ \frac{mg}{L} = \frac{(10^{-6})\,(70\,kg)}{SF[0.089\,L/day + (BCF)\,(0.02\,kg/day)]}$$

The equation for a non-carcinogen in waters not designated as public water supplies is:

$$Criteria\ \frac{mg}{L} = \frac{RfD \times 70\,kg}{0.089\,L/day + (BCF)\,(0.02\,kg/day)}$$

The equation for a carcinogen in non-drinking waters with secondary contact recreation (no swimming use) is:

$$Criteria\ \frac{mg}{L} = \frac{(10^{-6})\,(70\,kg)}{SF[(BCF)\,(0.02\,kg/day)]}$$

The equation for a non-carcinogen in non-drinking waters with secondary contact recreation (no swimming use) is:

$$Criteria\ \frac{mg}{L} = \frac{RfD(70\,kg)}{BCF(0.02\,kg/day)}$$

For excepted use water bodies, special procedures for calculating site-specific criteria may be used. In general, for water bodies with the primary contact recreation use removed, the incidental ingestion rate for water will also be removed from the equation. Most states do not have an incidental ingestion rate for swimmers, and, even so, most of Louisiana's human health criteria will be more stringent than other states. A use attainability analysis may show that a special water body supports only a limited fishery use. The fish population in this type of water body is not composed of typical sport fish for consumption. Instead, the fish are usually small and

inappropriate for human consumption. Therefore, for excepted use water bodies, Louisiana will use the national fish consumption rate of 6.5 grams per day, or another suitable fish consumption rate, rather than the usual 20 grams per day. Since many states use this or other fish consumption rates, Louisiana criteria for this type of water body will still be comparable to the human health criteria of other states.

Modifying the Criteria

Because toxicological information is subject to change, the scientific data must be checked periodically and updated, if necessary. Occasional comparisons of 1) EPA's IRIS and 2) the appropriate, most current criteria documents to LDEQ's human health criteria spreadsheet will facilitate any modifications to any particular criterion. If any of the criteria needs modifying, changes can most easily be made through the already established QUATTRO PRO spreadsheet.

Accessing the Spreadsheet

(Note: These instructions are written to enter the spreadsheet with a MOUSE. If one wishes to work within QUATTRO PRO strictly using his/her keyboard, he should use the ?/ key in conjunction with the arrow and ENTER key.)

To access the spreadsheet, at the C prompt type		cd QPRO
At the C:\QPRO> prompt, type		Q
Once in the spreadsheet, click on	FILE then	RETRIEVE
Click on the file named		TOXICCAL.WK2

YOU ARE NOW IN THE LDEQ HUMAN HEALTH CRITERIA TABLE.

To Make Changes to Parameters

Move cursor to desired cell (parameter-column and chemical-row), type in correction, and press ENTER

Screen will blink twice and new number(s), and new criteria, will appear.

To Edit the Formulas (for columns J, K, and L)

Arrow over to either column J, K, and/or L. Press F2 then use both the ← → keys and DELETE to make desired changes.

To keep changes, press ENTER.
(NOTE: IF YOU HAVE MADE UNDESIRABLE CHANGES, PRESS ESC TWICE TO START EDITING PROCESS OVER.)

To Print

Click on PRINT then BLOCK.

Once in BLOCK then type A3..M58 (or the line corresponding to the last chemical) and press ENTER.

To View New Table in Print Mode

a) In PRINT menu, click on DESTINATION. Next click on SCREEN PREVIEW.

b) With desired BLOCK (Axx..Nxx) entered, click on SPREADSHEET PRINT. Entire table will now appear on the screen.

c) To see table better, click on ZOOM(+) and CLICK-DRAG Red Box to desired part of the screen to check for corrections made.

d) Click on UNZOOM(-) then QUIT to return to PRINT menu.

e) If part of table did not show, click on LAYOUT then PERCENT SCALING.

f) Type in a reasonable value and press ENTER.

g) Click on QUIT.

h) Repeat steps b-g until desired appearance of table is achieved.

Click on DESTINATION once more; then on GRAPHICS PRINTER.

Click on SPREADSHEET PRINT.

YOUR NEW TABLE IS NOW PRINTING

To Save/Exit the Spreadsheet

IF YOU WANT TO SAVE YOUR CHANGES:
To save changes to existing file name, click on FILE menu then SAVE AS then ENTER.

IF YOU WANT TO SAVE YOUR CHANGES UNDER A NEW FILE NAME:
Follow the previous step.
Type in the new name before pressing ENTER (QUATTRO PRO REQUIRES NAME TO BE XXXXXXXX.WKX).

IF YOU DO NOT WANT ANY CHANGES SAVED AND/OR YOU WANT TO EXIT THE SPREADSHEET:
Click on FILE then EXIT.

THIS STEP WILL EXIT YOU FROM THE SPREADSHEET AND QUATTRO PRO WITHOUT SAVING ANY CHANGES MADE TO THE TABLE.

(IF THERE ARE ANY SPECIFICS YOU WANT DONE TO THE TABLE, PLEASE CONSULT THE QUATTRO PRO MANUAL.)

Adopted Dioxin Criteria
October 1991

Table A. Calculations used to derive the proposed 1991 dioxin (2,3,7,8-TCDD) criteria for the Louisiana Surface Water Quality Standards.

ASSUMPTIONS				CRITERIA[1]	
BCF[2]	FCR[3]	SF[4]	Risk Level	Drinking Water	Non-Drinking Water
5,000	20	9,700	10^{-5}	0.71	0.72

[1] Criteria expressed in parts per quadrillion (ppq)
[2] BCF = Bioconcentration Factor (L/Kg)
[3] FCR = Fish Consumption Rate (g/day)
[4] SF = Cancer Slope Factor (mg/Kg/day)
[5] DEQ 1989 revision includes 0.089 L/day incidental water ingestion for both drinking water and non-drinking water; an additional 2 L/day used only on drinking water
[6] 70 Kg = Average adult body weight

$$\text{Drinking Water (ppq)} = \frac{(10^{-5})(70\ \text{kg})^{6}}{\text{SF}\,[0.089 + 2\ \text{L/day} + (5{,}000\ \text{L/kg})(\text{FCR kg/day})]}$$

$$\text{Non-Drinking Water (ppq)} = \frac{(10^{-5})(70\ \text{kg})}{\text{SF}\,[0.089\ \text{L/day} + (5{,}000\ \text{L/kg})(\text{FCR kg/day})]}$$

APPENDIX B-2: Rationale for Development of Numeric Targets in Louisiana 303(d) Streams Listed for Pesticides

The Environmental Protection Agency (EPA), Region 6, Water Quality Protection Division has developed numeric targets for pesticides, identified through analytical measurements, to evaluate the need for development of Total Maximum Daily Loads (TMDL) in waterbodies identified and listed as not in attainment of the State of Louisiana water quality standards, as required under §303(d) of the Clean Water Act (CWA). This action was necessary to both evaluate the need for TMDL development and as a goal when a TMDL is required. The development of the numeric targets has been performed without prior knowledge of the analytical values obtained by the Louisiana Department of Agriculture and Forestry (LDAF) through water quality monitoring. The list of analytes was reviewed by senior staff and management in the EPA Region 6, Multimedia Planning and Permitting Division, who provided Chemical Abstract Service (CAS) numbers and product names for each pesticide. Where the State of Louisiana has established water quality criteria, those criteria were used for screening. Where the EPA has developed (or drafted but not finalized) recommended aquatic life protection criteria for a pesticide, but the State of Louisiana had not adopted the criteria, the EPA recommended criteria was used as a numeric target. For all other measured pesticides numeric targets were established in accordance with the State of Louisiana Water Quality Standards and established procedures submitted to EPA Region 6.

In accordance with LAC 33:IX.1113.C.6.b., acute and chronic aquatic life values were developed, based on information contained in EPA's ECOTOX (ecological toxicity) database and from EPA's Office of Pesticides database, supplied by the Region 6 Multimedia Planning and Permitting Division, Pesticides Section. LAC 33:IX.1113.C.6.b. states;

> "The criteria for protection of aquatic life are based on acute and chronic concentrations in fresh and marine waters as specified in the EPA criteria documents and are developed primarily for attainment of the fish and wildlife propagation use. Where a specific numerical criteria is not derived in EPA criteria documents, a criterion is developed by applying an appropriate application factor for acute and chronic effects to the lowest LC_{50} value for a representative Louisiana species."

In implementing this provision EPA reviewed the available data and used the lowest 48-hour LC_{50} values for invertebrate species indigenous to Louisiana, and the lowest 96-hour LC_{50} values for vertebrate species indigenous to Louisiana. EPA utilized application factors of 0.1 for acute criteria and 0.05 for chronic criteria, in accordance with the document submitted to EPA Region 6 *"Documentation of Numerical Criteria for Acute and Chronic Aquatic Life Protection in the 1989 Water Quality Standards Revisions"*, dated June 1989. Where multiple data points were available the geometric mean was utilized for test data points. Data from different sources was evaluated to determine if concentrations were measured analytically or were based on a formulation and a dilution calculation, with a preference for measured concentrations. However; if only calculated concentrations were available, based on formulated products and calculated concentrations, that data was used in determining the acute and chronic numeric targets (products of LC_{50} and application factor).

For the compound Fipronil EPA contacted the US Department of Agriculture and Louisiana State University (LSU) to obtain information concerning the effects of Fipronil to crayfish, based on complaints of the adverse effects this pesticide was having on crayfish farming. At this time LSU is conducting toxicity tests using crayfish and examining the effects on different life stages and size. Because some of the degradation products of Fipronil are more toxic than the parent compound, establishing a numeric target that considers the toxicity of the parent compound and the degradation products will be difficult and time consuming. For the purpose of this activity, data from the EPA database was used in establishing a numeric target for aquatic life protection.

No calculations were necessary for pesticides that have Louisiana adopted water quality criteria for aquatic life protection or for EPA recommended water quality criteria for the protection of aquatic life. Numeric targets developed for the remaining pesticides were established using the following formulae:

Acute numeric target = (LC_{50}) X 0.1

Chronic numeric target = (LC_{50}) X 0.05

Example Calculation:

Acute numeric target for Anilazine = 3.0 µg/l (LC_{50} for *Ceriodaphnia dubia)* X 0.1
= 0.3 µg/l

Chronic numeric target for Anilazine = 3.0 µg/l (LC_{50} for *Ceriodaphnia dubia*) X 0.05
= 0.15 µg/l

APPENDIX C: LDAF Pesticide Monitoring Data (1997-1999)

			1997				1998				1999			
Station	Compound	Numeric Target	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
WM-S-C-03	2,4-D	327					0.64							
WM-S-C-05	2,4-D	327					0.98							
WM-S-C-06	2,4-D	327					0.61							
WM-S-C-07	2,4-D	327					0.71							
WM-S-C-08	2,4-D	327					1.05							
WM-S-O-02	2,4-D	327					0.54							
WM-S-O-05	2,4-D	327						1.82						
WM-S-C-05	AROCHLOR 1254										6.42			
WM-S-A-04	ATRAZINE	11.56						4.04						
WM-S-C-05	ATRAZINE	11.56						5.06						
WM-S-C-06	ATRAZINE	11.56						0.43						
WM-S-C-07	ATRAZINE	11.56					2.3	0.3						
WM-S-O-01	ATRAZINE	11.56		1.12										
WM-S-O-03	ATRAZINE	11.56						0.54				0.46		0.68
WM-S-O-04	ATRAZINE	11.56			0.36			1.32			0.48	8.23	0.24	
WM-S-O-06	ATRAZINE	11.56			0.26	0.22		1.37			1.1	2.55	0.26	
WM-S-O-07	ATRAZINE	11.56			0.42		0.36	4.26			0.73	0.28		3.72
WM-S-O-07	ATRAZINE	11.56										3.85		
WM-S-O-08	ATRAZINE	11.56			0.68	0.31	0.69					2.49		3.83
WM-S-O-09	ATRAZINE	11.56			0.64	0.39		0.48			0.29	1.65	0.72	0.52
WM-S-O-10	ATRAZINE	11.56		1.71	0.38			2.56				2.88	0.39	
WM-S-O-11	ATRAZINE	11.56		3.38	0.4	0.33		2.64				6.38	0.28	0.49
WM-S-A-04	BROMACIL	9,300			0.79			1.48						
WM-S-C-08	BROMACIL	9,300					0.32							
WM-S-O-09	BROMACIL	9,300												0.57
WM-S-C-04	CYANAZINE (BLADEX)	635			0.05									
WM-S-A-04	DIAZINON	0.1			0.15									
WM-S-O-05	FIPRONIL	2.3										0.31		
WM-S-O-04	METOLACHLOR (DUAL)	100										0.84		
WM-S-O-07	METOLACHLOR (DUAL)	100										0.74		1.65

WM-S-O-10	METOLACHLOR (DUAL)	100										1.15		
WM-S-C-06	METOLACHLOR (DUAL)	100						0.32						
WM-S-O-04	METOLACHLOR (DUAL)	100						0.51						
WM-S-O-06	METOLACHLOR (DUAL)	100						1.17						
WM-S-O-10	METOLACHLOR (DUAL)	100						0.93						
WM-S-O-11	METOLACHLOR (DUAL)	100						0.4						
WM-S-C-05	METRIBUZIN (SENCOR)	100				0.29								
WM-S-C-07	METRIBUZIN (SENCOR)	100				0.3								
WM-S-O-07	METRIBUZIN (SENCOR)	100												0.15
WM-S-O-08	METRIBUZIN (SENCOR)	100												0.89
WM-S-O-09	METRIBUZIN (SENCOR)	100												0.43
WM-S-O-11	METRIBUZIN (SENCOR)	100										1.85		
WM-S-O-01	METRIBUZIN (SENCOR)	100		0.65										
WM-S-O-07	METRIBUZIN (SENCOR)	100						0.48						
WM-S-O-10	METRIBUZIN (SENCOR)	100		0.22										
WM-S-O-11	METRIBUZIN (SENCOR)	100		0.23										
WM-S-O-03	MOLINATE (ORDRAM)	16.35										1.7		
WM-S-O-08	MOLINATE (ORDRAM)	16.35										0.3		
WM-S-C-03	MOLINATE (ORDRAM)	16.35						5.43						
WM-S-C-04	MOLINATE (ORDRAM)	16.35		1.65				1.3						
WM-S-C-05	MOLINATE (ORDRAM)	16.35		7.6				11.2						
WM-S-C-06	MOLINATE (ORDRAM)	16.35						2.03						
WM-S-C-07	MOLINATE (ORDRAM)	16.35		1.51				3.36						
WM-S-C-08	MOLINATE (ORDRAM)	16.35		3.61				2.13						
WM-S-O-02	MOLINATE (ORDRAM)	16.35		1.53				4.92				1.49		
WM-S-O-05	MOLINATE (ORDRAM)	16.35						10.8				1.74		
WM-S-O-09	OXADIASON	120						0.18						
WM-S-C-04	PROPANIL	77											0.02	
WM-S-O-05	PROPICONAZOLE	146			0.49									
WM-S-O-08	TERBACIL	1,697												0.32

APPENDIX D: USGS Carbofuran Data for Water Years 1999 & 2000

USGS Station Number	Station Name	Date	82674 Carbofuran filtered ug/l	No. Sampling Trips
08010000	Bayou Des Cannes Nr Eunice, La	9/12/98	E.109	31
		11/17/98	<.0030	
		12/16/98	<.0030	
		1/13/99	<.0030	
		2/10/99	<.0030	
		3/10/99	<.0030	
		3/24/99	<.0030	
		4/7/99	E.0273	
		4/20/99	<.0030	
		5/13/99	<.0030	
		5/26/99	<.0030	
		6/9/99	<.0030	
		6/24/99	**E.965**	
		7/7/99	**E.151**	
		7/28/99	<.0030	
		8/10/99	E.0105	
		9/1/99	<.0030	
		10/7/99	E.0369	
		11/3/99	<.0100	
		12/9/99	E.0223	
		1/19/00	E.0628	
		2/10/00	E.0384	
		2/22/00	E.0228	
		3/9/00	<.0030	
		3/22/00	E.0492	
		4/5/00	E.0268	
		4/18/00	<.0030	
		5/10/00	<.0200	
		6/21/00	E.0864	
		6/27/00	E.0201	
		7/19/00	<.0100	
08012150	Mermentau River @ Mermentau, La	9/12/98	E.0656	32
		11/12/98	<.0030	
		12/15/98	<.0030	
		1/12/99	<.0030	
		2/9/99	<.0030	
		3/9/99	<.0030	
		3/23/99	<.0030	
		4/8/99	<.0030	
		4/21/99	<.0030	
		5/14/99	<.0030	
		5/26/99	E.0509	
		6/8/99	**E.705**	

	6/23/99	**E.744**	
	7/8/99	E.111	
	7/29/99	**E.147**	
	8/10/99	E.0122	
	9/2/99	E.0192	
	10/7/99	<.0030	
	11/2/99	<.0030	
	12/8/99	E.0087	
	1/11/00	<.0300	
	2/9/00	<.0250	
	2/23/00	E.0088	
	3/8/00	<.0030	
	3/23/00	<.0030	
	4/4/00	<.0030	
	4/19/00	E.0736	
	5/9/00	E.0374	
	5/31/00	E.0293	
	6/20/00	E.0370	
	6/28/00	E.0237	
	7/18/00	E.0595	
08012470 Bayou Laccassine Nr Lake Arthur, La.	9/12/98	E.0259	32
	11/12/98	<.0030	
	12/15/98	E.0130	
	1/12/99	<.0030	
	2/9/99	<.0030	
	3/9/99	<.0030	
	3/24/99	<.0030	
	4/8/99	<.0030	
	4/21/99	<.0030	
	5/13/99	<.0030	
	5/26/99	<.0030	
	6/8/99	<.0030	
	6/24/99	E.116	
	7/8/99	E.0619	
	7/29/99	<.0030	
	8/10/99	<.0030	
	9/2/99	<.0030	
	10/6/99	<.0030	
	11/2/99	<.0030	
	12/8/99	<.0030	
	1/11/00	<.0030	
	2/9/00	<.0030	
	2/24/00	<.0030	
	3/8/00	<.0030	
	3/23/00	<.0030	
	4/4/00	<.0030	
	4/20/00	<.0030	
	5/9/00	<.0030	
	6/1/00	<.0030	

		6/20/00	<.0030	
		6/28/00	<.0030	
		7/18/00	**E.163**	
30044609 2214200	Bayou Queue de Tortue at LA-Hwy 13 nr Lelieux, LA	2/25/00	<.0030	5
		3/24/00	**E.446**	
		4/20/00	E.0206	
		6/1/00	<.0030	
		6/28/00	<.0030	
08012300	BYU QUEUE DE TORTUE @ RICEVILLE, LA	2/24/00	<.0100	5
		3/23/00	**E.636**	
		4/20/00	E.119	
		6/1/00	<.0030	
		6/29/00	E.0401	

* E = Exceeds upper end of calibration range

APPENDIX E: Summary Table of Carbofuran Exceedances From USGS Pesticide Monitoring Data

Station Number	Station Name	Water Year		Exceed per # of samples	% Exceed	Rating
		1998/99	1999/20			
08010000 *	Bayou Des Cannes nr Eunice. LA	E 0.965		2/31	6%	PS
		E 0.151				
08012150	Mermentau River @ Mermentau, LA	E 0.705		3/32	9%	PS
		E 0.744				
		E 0.147				
08012470	Bayou Laccassine nr Lake Arthur, LA.		E 0.163	1/32	3%	FS
08012300	Bayou Queue de Tortue @ Riceville, LA		E 0.636	1/5	20%	FS
300446092214200	Bayou Queue de Tortue @ Hwy 13 nr Lelieux		E 0.446	1/5	20%	FS

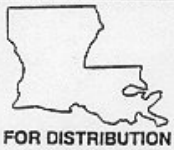
* sampling location same as LDAF Station WM-S-O-05
E= estimated values (exceeds upper end of calibration range)
FS = Fully Supporting
PS = Partially Supporting (needs TMDL)
NS= Not Supporting (needs TMDL)

APPENDIX F: Furadan® 4F Registered Use Pesticide Label From FMC Corporation

RESTRICTED USE PESTICIDE

Due to acute oral and inhalation toxicity.
For retail sale and application only by certified applicators or personnel under their direct supervision.

Section 18 Exemption



FOR DISTRIBUTION AND USE ONLY IN LOUISIANA

Furadan® 4F

Insecticide-Nematicide

For Agricultural or Commercial Use Only

EPA REG. No. 279-2876

EMERGENCY CALLS: 800-331-3148

This exemption expires

IT IS A VIOLATION OF FEDERAL LAW TO USE THIS PRODUCT IN A MANNER INCONSISTENT WITH ITS LABELING.

CROP	PEST	RATE OF APPLICATION
Cotton	Cotton Aphid	1/2 pint (.25 pound active) per acre

DIRECTIONS FOR USE:

Use Furadan 4F at a rate of 1/2 pint per acre. A maximum of 2 applications per season may be made. Applications may be made with air or ground application equipment. Use a minimum of 2 gallons of finished spray per acre by air or 10 gallons of finished spray per acre by ground application.

RESTRICTIONS: State pesticide authorities, extension personnel or crop consultants must document resistance and infestation levels before "prescribing" foliar use on cotton as described in the EPA Specific Exemption approval document. Prior to using Furadan 4F as a foliar cotton treatment, applicators shall obtain and review the specific stewardship information materials available from FMC through direct mailings, retail distribution and extension information channels. A copy of the Section 18 label and the stewardship information shall be in the possession of the user/applicator prior to application. Do not use Furadan 4F through any type of irrigation system. Do not apply within 27 days of harvest. Do not feed cotton forage.

TREATMENT CRITERIA: No use of flowable carbofuran will be permitted unless the following conditions are met:

1. Limit use of flowable carbofuran to only those areas that can provide documentation of treatment failures attributable to resistance. In the absence of such documentation, growers should be allowed to use flowable carbofuran only if application of a recommended aphicide has failed (less than 80 percent control) and aphid populations have again reached the treatment threshold.
2. During the period when the cotton plants have developed their 6th set of leaves until they bloom, flowable carbofuran should be used when aphid populations reach the treatment threshold of 50 aphids per leaf as determined by the following sampling plan: Sample 1 top leaf (first fully expanded leaf) and 1 mid leaf (3 nodes below "top" leaf) per plant on 5 randomly selected plants 100 feet from edge of field. Repeat in each of the four quadrants of the field until a total of 40 leaves are collected. Treat only if aphid populations exceed an average of 50 per leaf.
3. When the cotton plants have bloomed, fields may be treated when a threshold of 100 aphids per leaf are present. To determine the number of aphids per leaf, sample 1 top leaf (first fully expanded leaf) and 1 mid leaf (5 nodes below "top" leaf) per plant on 5 randomly selected plants 100 feet from edge of field. Repeat in each of the four quadrants of the field until a total of 40 leaves are inspected. Treat only if aphid populations exceed 100 aphids per leaf.

HANDLING INSTRUCTIONS: Use of closed mixing and loading systems for both aerial and ground application is required. Handlers of carbofuran are required to wear coveralls over a long-sleeved shirt and long pants, shoes and socks for each job function, chemical resistant apron (when cleaning equipment, mixing or loading), chemical resistant headgear for overhead exposure, protective eye wear, chemical resistant gloves and respirator.

REENTRY AND POSTING REQUIREMENTS: After foliar applications on cotton, do not enter or allow workers to enter into treated areas within 48 hours without wearing Coveralls, Chemical-resistant gloves, Shoes and socks. If prolonged intimate contact with cotton will result do not enter or allow workers to enter treated areas for 14 days without wearing Coveralls, Chemical-resistant gloves, Shoes and socks. Prior to treatment, treated fields must be posted with Worker Protection Standard signs.

00-LA-XX

(Continued next page)

ENVIRONMENTAL HAZARDS: In order to protect Federally-listed threatened and endangered species, users must abide by all restrictions in the Environmental Hazards section of the Furadan 4F federal label. In addition, application is prohibited within one (1) mile of bald eagle nests; within 100 yards for ground applications and 1/4 mile for aerial applications for other terrestrial species; and within 20 yards for ground applications and 100 yards for aerial applications for aquatic species. Do not apply directly to water, including immediately before or during irrigation. Do not apply where run-off is likely to occur to aquatic habitats. Do not make aerial applications within 200 yards, or ground applications within 20 yards of bodies of water, including rivers, streams, lakes, ponds, bogs, etc. Cotton growing areas treated with flowable carbofuran must be surveyed for wildlife mortality under supervision by wildlife management professionals. Monitoring/surveys must be sufficient to demonstrate that widespread wildlife mortality is not occurring. Fields should be monitored shortly after application. REIs must be observed or protective clothing must be worn by search personnel.

SPRAY DRIFT MANAGEMENT: In order to minimize risk of spray drift, the following measures must be adhered to:

a. The distance of the outer-most nozzles on the boom must not exceed 3/4 of the length of the wingspan or rotor.

b. Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.

c. Use high flow nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.

d. Do not exceed the nozzle manufacturer's recommended pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.

e. Use the minimum number of nozzles that provide uniform coverage.

f. Orienting nozzles so that the spray is released parallel to the airstream produces larger droplets than other orientations, and is the recommended practice. Significant deflection from horizontal will reduce droplet size and increase drift potential.

g. Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the least drift.

h. For some use patterns, reducing the effective boom length to less than 3/4 of the wingspan or rotor length may further reduce drift without reducing swath width.

i. Applications should not be made at a height greater than 10 feet above the top of the largest plants, unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

j. When applications are made with a cross wind, the swath will be displaced downward. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase with increasing drift potential (higher wind, smaller drops, etc.)

k. Drift potential is lowest with wind speeds between 2-10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Application should be avoided at wind speed below 2 mph due to variable wind direction and high inversion potential. Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

l. When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

m. Applications should not occur during a temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions, due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude, and are common nights with limited cloud cover and light to no winds.

n. Pesticides should only be applied when the potential for drift to adjacent sensitive areas (e.g., residential areas, bodies of water, know habitat for threatened or endangered species, non-target crops is minimal (e.g. when the wind is blowing away from the sensitive area).

ALL APPLICABLE DIRECTIONS, RESTRICTIONS AND PRECAUTIONS ON THE EPA REGISTERED LABEL MUST BE FOLLOWED. PERSONAL PROTECTIVE EQUIPMENT AND REENTRY INTERVALS ON THIS LABELING OR ON THE BASIC LABEL MUST BE FOLLOWED.
THIS LABELING MUST BE IN THE POSSESSION OF THE USER AT THE TIME OF PESTICIDE APPLICATION.

FMC Corporation
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